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A Comparative Study of Bonded Rare Earth and Ferrite Magnet Motors for Electric Two-wheelers

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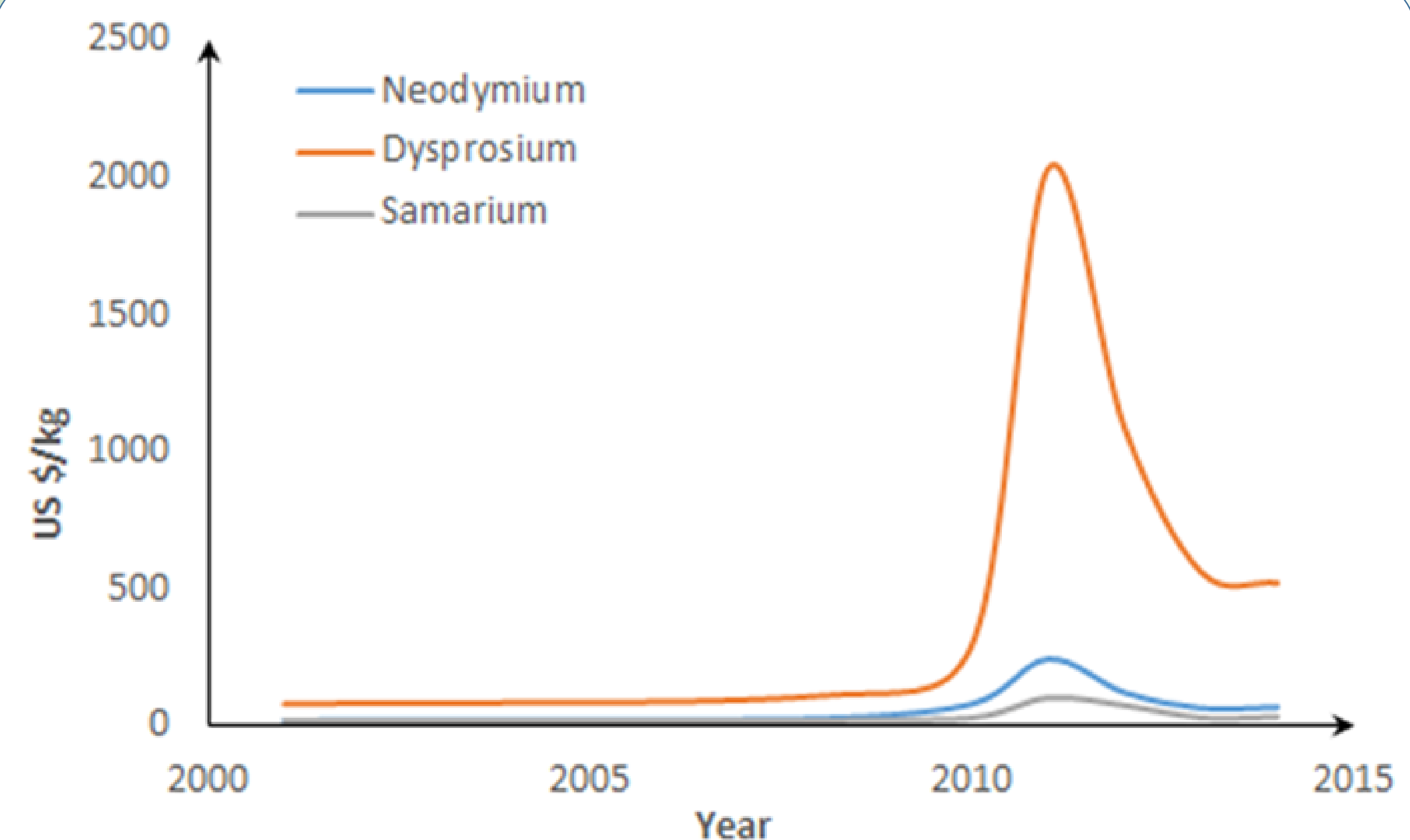
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In recent years, there has been an uncertainty about the availability and the price of rare earth metals. There are large number of applications such as automotive component motors, wind turbines, etc., where rare earth magnets are used only because ferrite magnets do not fulfil the energy product requirements.

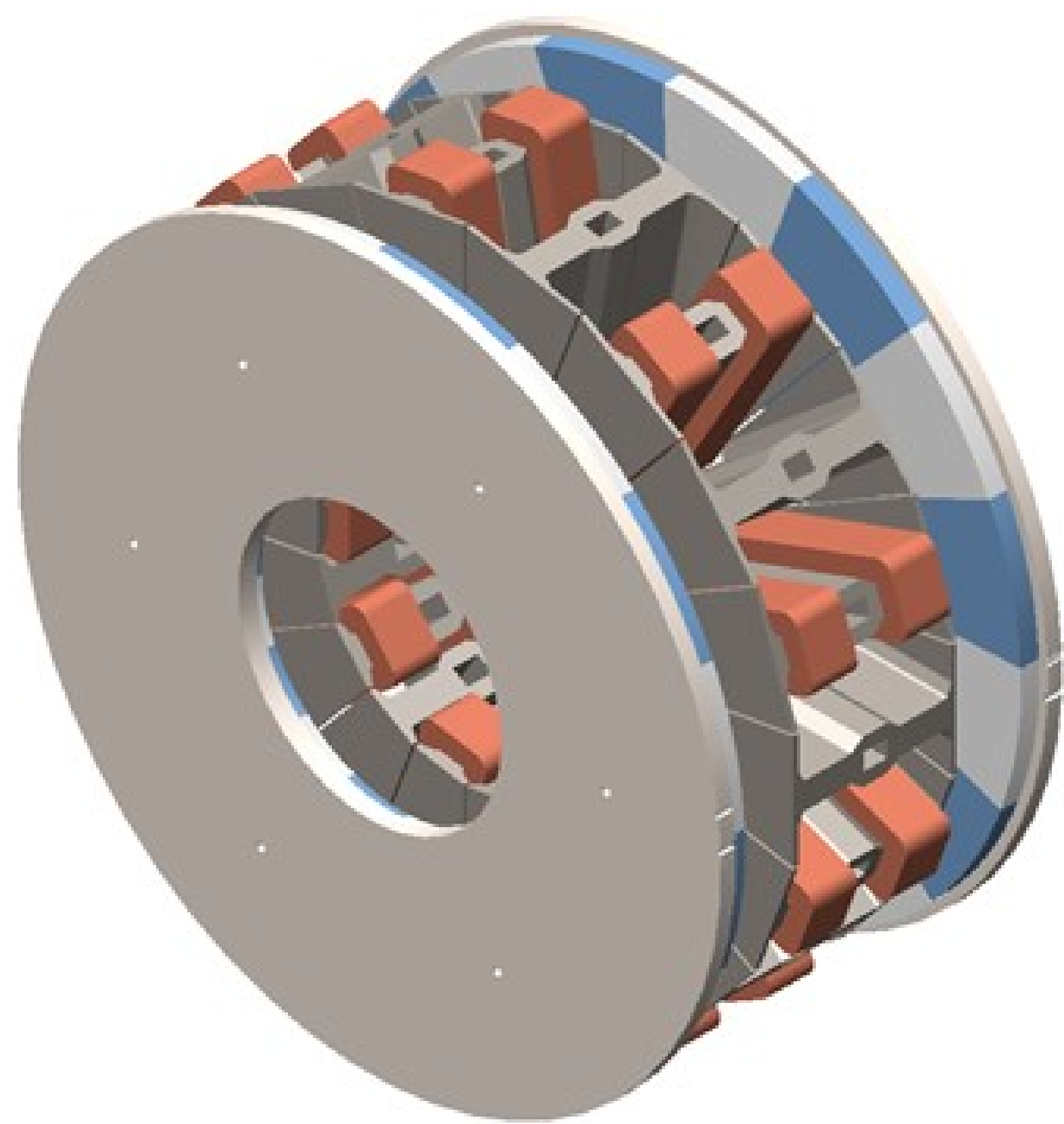
In this project, two PMBLDC motors made from bonded rare earth and ferrite magnets will be developed and their performance will be compared to an existing sintered rare earth magnet motor.

Project aims to demonstrate

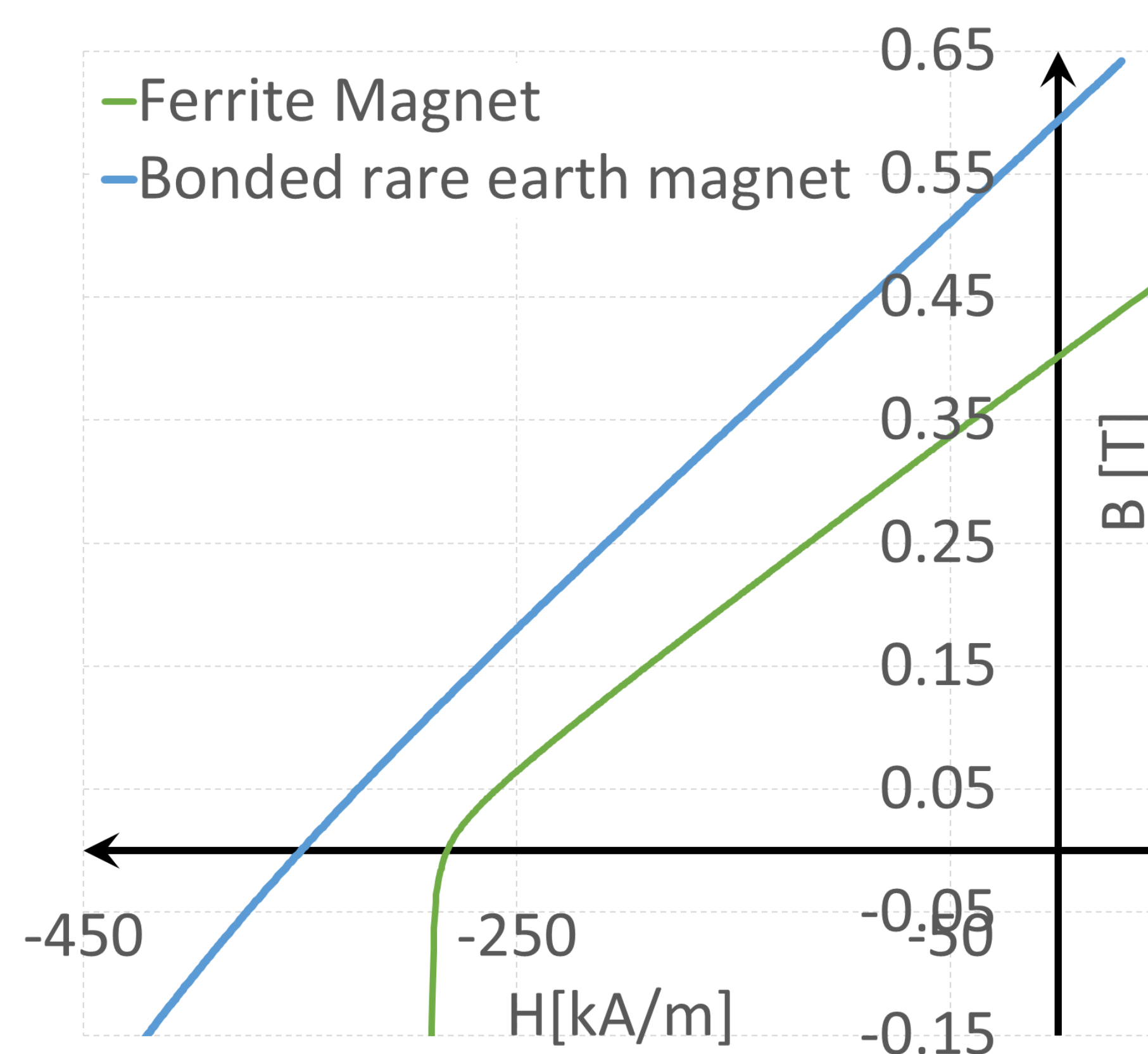
- Stability of ferrite magnets in a demanding application
- Low-cost electric powertrain



Price of rare earth metals

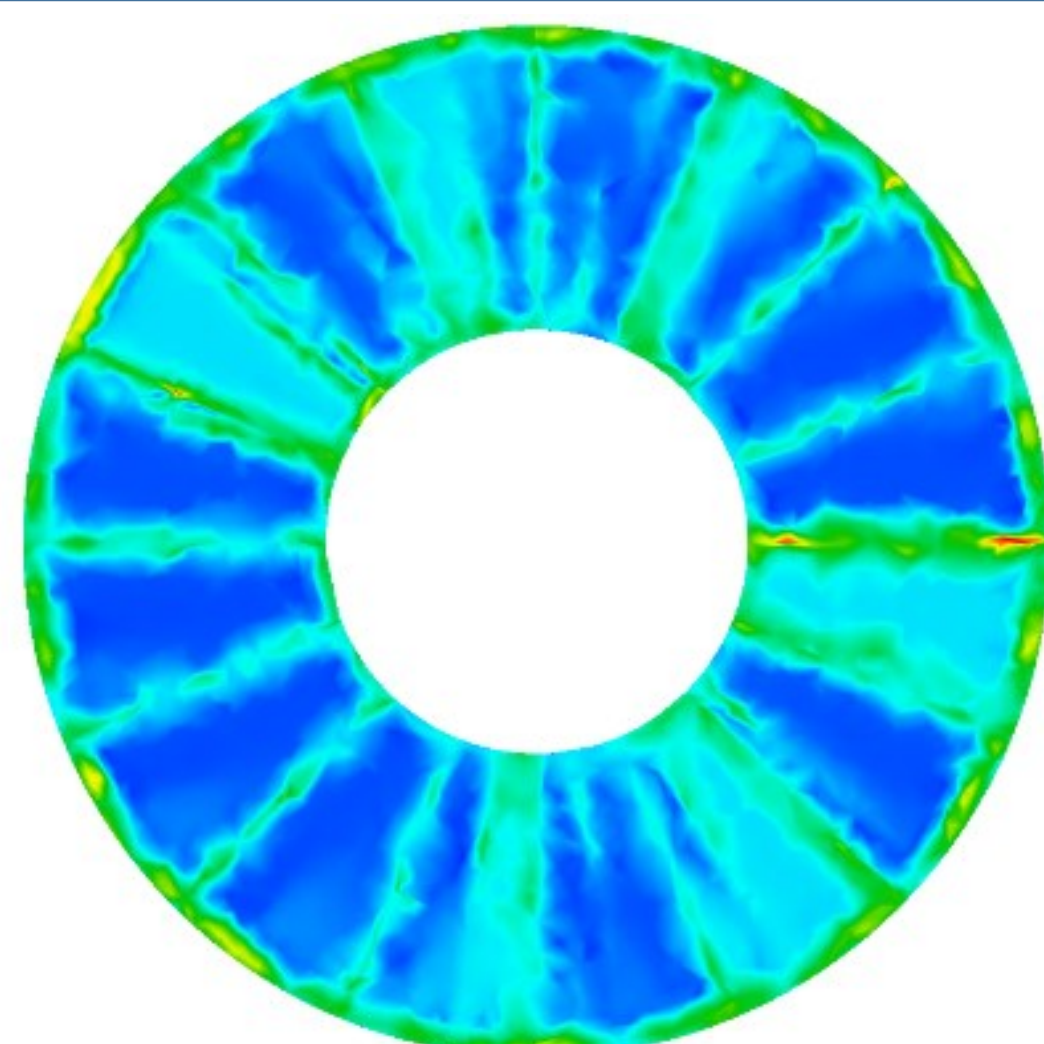
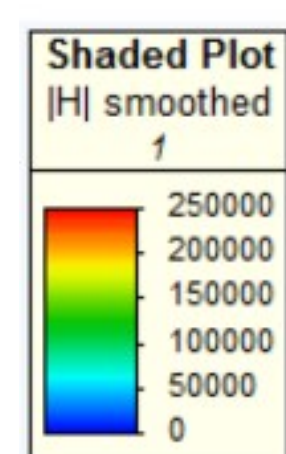


Selected motor topology

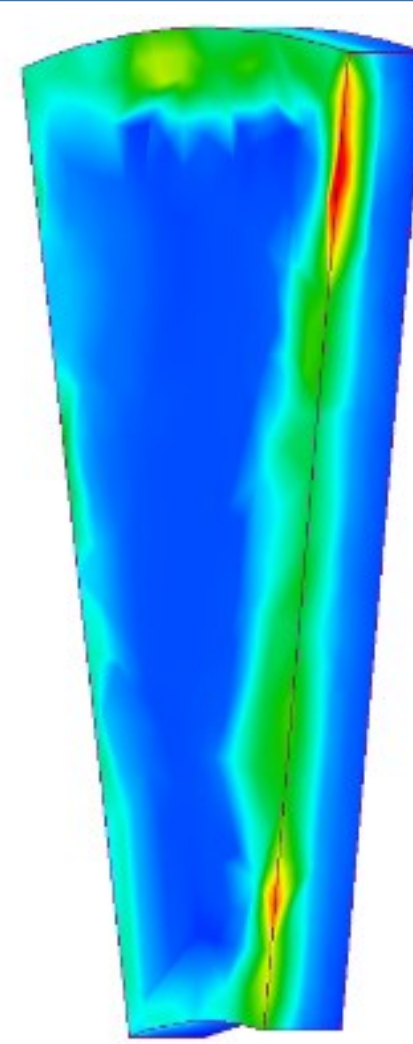


Magnet characteristics

Design comparisons		
Parameter	Ferrite magnet	Bonded NdFeB
Outer diameter	275 mm	260 mm
Poles-slots	16-18	16-18
Number of	18	18
Length of air gap	0.4 mm	0.4 mm
Current density	4.5 A/mm ²	4.5 A/mm ²
Length of magnet	7.5 mm	7 mm
Diameter ratio	0.45	0.45
Rotor yoke depth	6 mm	8 mm
Axial width of tooth	10.80 mm	10.20 mm
No. of turns/coil	34	28
Length of tooth	37.56 mm	32.80 mm
Full load current	22.48 A	21.96 A
Conductive loss	70.99 W	53.97 W
Length of motor	65.36 mm	63.61 mm

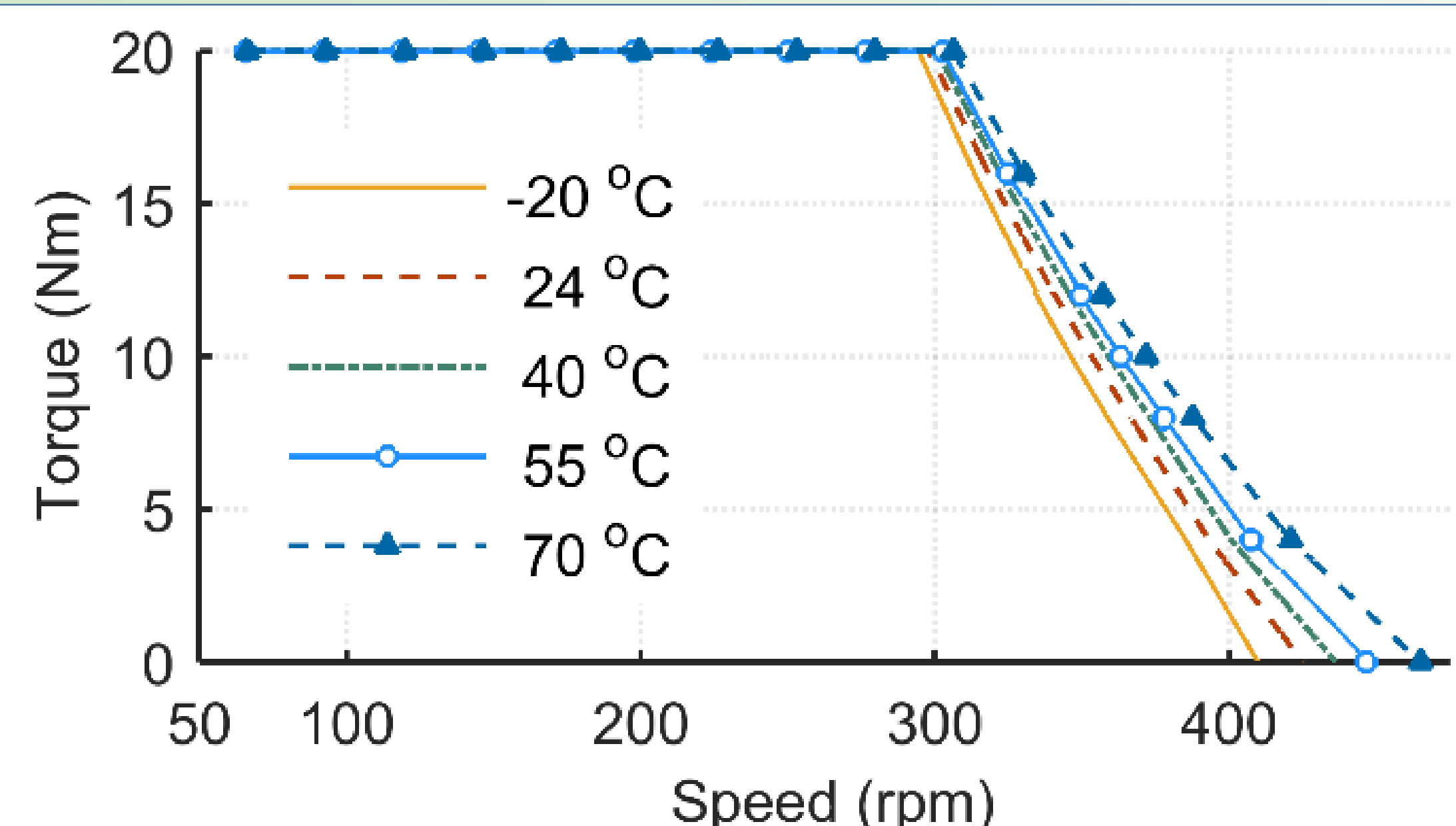


(a)



(b)

Finite element study to check the possibility of demagnetization of ferrite magnet poles



Output torque of ferrite magnet motor for different magnet temperature